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An Investigation into In-Situ Nasal Gels for Enhanced Nasal Drug Delivery Systems

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Abstract: *The nasal cavity's rich blood supply significantly enhances drug absorption and bioavailability compared to other administration routes, making intranasal delivery highly desirable for systemic circulation. To prolong the retention time of in-situ gels on the nasal mucosa, biocompatible mucoadhesive polymers are employed in these drug delivery systems. In-situ nasal gels are administered as low-viscosity solutions that transform into gels upon contact with the nasal mucosa, minimizing first-pass metabolism, reducing enzymatic degradation, and preventing gastrointestinal ulcers. This controlled and sustained drug delivery system is particularly advantageous for drugs with poor oral bioavailability due to gastric irritation or extensive hepatic metabolism. Various stimuli-responsive polymers are used in gel formulations to enable precise control over drug release kinetics, based on gelation strength and viscosity. Given the limitations of oral drug administration, such as poor absorption and targeting difficulties, intranasal delivery offers a promising alternative. This review discusses the therapeutic advantages, nasal anatomy and physiology, challenges, opportunities, marketed products, and evaluation parameters for in-situ gel preparations in nasal drug delivery.*

Keywords: Polymer, in-situ drug delivery, formulation, mucoadhesion, metabolism, sustained release, nasal anatomy, bioavailability, transmucosal delivery, nasal gels